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DEPARTMENT OF STATE LANDS

THOMAS L. JUDGE, GOVERNOR
CAPITOL STATION
STATE OF MONTANA
(406) 449-2074
LEO BERRY, COMMISSIONER
1625 ELEVENTH AVENUE
HELENA, MONTANA 59601

January 15, 1980

PLEASE RETURN

Attached is the Preliminary Environmental Review (PER) for the offering of a 170 acre tract in the E½ of Section 36, Township 2 North, Range 40 East, Rosebud County, Montana, by the Department of State Lands for coal mining purposes on a cash bonus competitive bid basis. This PER was prepared by the State of Montana, Department of State Lands.

This document was prepared in compliance with the Montana Environmental Policy Act (MEPA), Chapter 1, Title 75 MCA and the rules adopted thereunder. A comment period ending February 5, 1980, has been established to allow interested persons to review the attached PER and submit comments to the Montana Department of State Lands. Comments should be addressed to:

Mr. Leo Berry, Jr., Commissioner
Department of State Lands
Capitol Station
Helena, MT 59601

The Department is particularly interested in receiving comments regarding the state's proposed minimum royalty rate, rental rate, and cash bonus. Since preparation of the PER, the Department has learned that the federal royalty rates for adjacent coal lands are in the process of being revised. Because the federal royalty rates were considered in the development of the state's proposed royalty rates, a rate proposal will be made only after a review of comments received and a comparison with the revised federal royalty rates.

STATE DOCUMENTS COLLECTION

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A. THE PROPOSED ACTION

The Montana Department of State Lands (Department) received an application from Western Energy Company (WECO) to lease state-owned land in the E½ of Section 36, Township 2 North, Range 40 East, Rosebud County, Montana, in January of 1979. The state land lies contiguous to WECO's mining area A which contains lands presently scheduled for mining by WECO (Figure 1). The Department has determined that if this tract is not mined as a planned portion of the strip mining operation currently existing in the vicinity, it may not be economically feasible to mine the state-owned coal at a future date. Therefore, pursuant to its authority under Title 77, Chapter 3, Part 3 MCA and ARM 26.3.301-323, the Montana Board of Land Commissioners proposes to offer a 170 acre tract in the E½ of Section 36 for coal mining purposes on a cash bonus competitive bid basis.

The following is a Preliminary Environmental Review (PER) prepared by the Department on the action of offering the lease tract for coal mining purposes. Although it is likely that the applicant will be successful in obtaining the coal lease, this cannot be confirmed because of the competitive bid basis of the lease sale. Because of this, and the subsequent lack of a proposed mining plan for the tract, it is considered premature to attempt to include a detailed discussion in the PER of the potential for impacts on the lease tract or adjacent lands that may result from the inclusion of the lease area in any future strip mining of the area.

Approval of a coal lease by the Land Administration Division of the Department does not represent a committment to, nor imply future favorable review by the Departments' Reclamation Division of subsequently proposed mining involving the lease area.

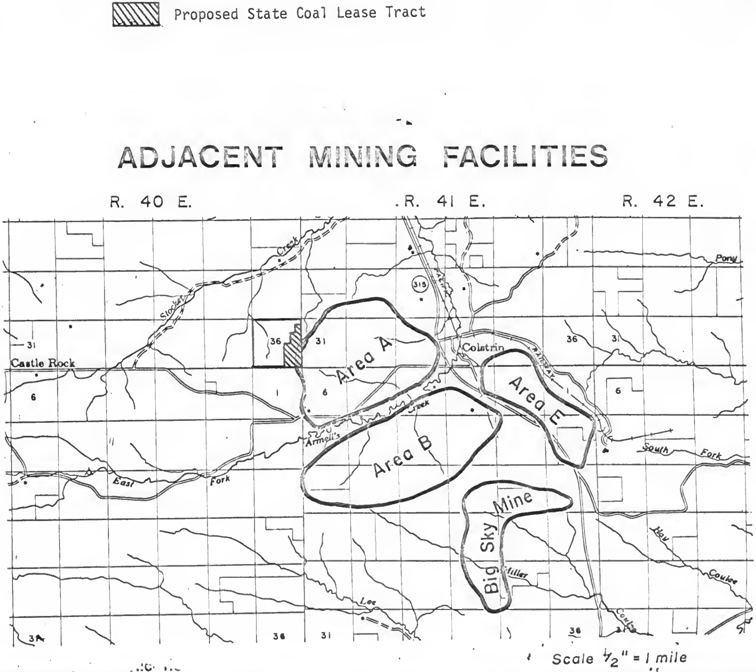


Figure 1. Adjacent Mining Facilities, Colstrip, Montana Area

Before a coal strip mine can be developed on the lease tract, a proposed plan of mining and reclamation must be submitted to the Department for approval in accordance with the Strip and Underground Mine Reclamation Act, 82-4-222 MCA. A further comprehensive environmental evaluation will be prepared for any proposed mining plan involving the lease tract in compliance with the Montana Environmental Policy Act, Chapter 1, Title 75 MCA and the rules adopted thereunder.

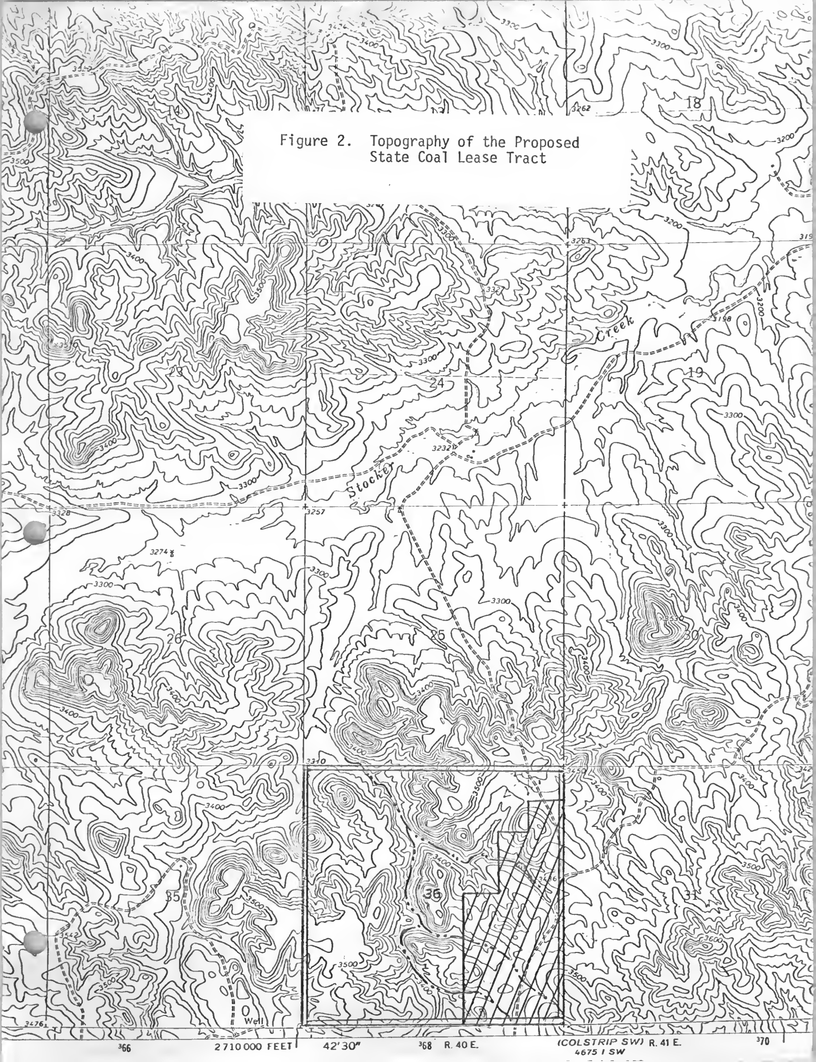
B. THE PHYSICAL ENVIRONMENT

1. Topography

The lease application area is in the unglaciated Missouri Plateau section of the Great Plains Physiographic Province. The topography of the region is characterized by narrow ridges, isolated knolls and buttes, gently sloping hill sides, generally narrow floodplains and wide, shallow valleys.

WECO Area A is essentially an upland ridge bordered on the south and east by the broad valley of the East Fork of Armells Creek. A ridge line of dissected mesas and buttes trend northeastward from the northern part of the area. The topography of the proposed lease area is shown in Figure 2. That portion of the lease area that has been determined to have a mineable coal reserve is along the extreme eastern boundary of Section 36 and can be characterized as the gently sloping basal portion of the rolling hills trending from southwest to northeast through adjacent Section 31.

Figure 2. Topography of the Proposed State Coal Lease Tract



If a mining plan for the lease area is developed and proposed in the future, the reestablishment of acceptable post-mining topography will occur in full compliance with the provisions of 82-4-232 (1) MCA and the rules that have been adopted thereunder. There are no unique or exceptional topograpic features in the proposed lease area that are considered to present a significant potential for problems in the development of an acceptable post mining topography.

2. Geology

The geology of the region surrounding the lease area is described in detail by Dobbin, 1929; Pierce, 1936; and Kepferle, 1954. Sedimentary strata underlying the subject area consist mainly of marine deposits that accumulated as the result of the transgression of seas during the Paleozoic and Mesozoic Eras. Deposits of the Cretaceous Bearpaw Shale represent the last invasion of seas over the area, about 100 million years ago. The non-marine Paleocene Fort Union Formation overlies the Cretaceous sediments. The Tongue River Member is the uppermost member of the Fort Union Formation in this region and the most important in terms of coal resource. In addition to sandstone, the member consists of interbedded silty and carbonaceous shale, siltstone and coal. Scoria occurs in areas where the coal beds have burned and baked the overlying material.

a. Coal

At least ten coal seams are known to persist throughout the region. Within the proposed lease area, only the Rosebud and McKay beds are of economic interest.

Western Energy Company was granted a Coal Exploration Lease on June 27, 1977 by the Department of State Lands to drill and obtain geologic information regarding the state-owned coal underlying the proposed lease tract.

A total of 48 holes were drilled, of which two were cored and analyzed. The core holes include Number 36-44 (36 being the section number and 44 the hole number) in which both the Rosebud and the McKay were cored. However, in Hole Number N51 E38B only the McKay was cored, because the Rosebud was of such poor quality that a core could not be recovered. Geophysical Logs were compiled on all of the holes except three and include Gamma, Density, Spontaneous Potential and Resistivity surveys. Unstable hole conditions were encountered in the three holes and they could not be logged. A geologist's log describing the lithology of the overburden was taken, as well as a driller's log which details the degree of oxidation and thickness of coal in each hole. Detailed information regarding these exploration holes is available for review in the Department's Helena office and includes:

1. Map showing hole numbers and locations.
2. 44 Geophysical Logs.
3. Lithologic log and Driller's Log with collar elevations.

The analysis of cored holes 36-44 and N51 E38B are attached to this PER as Appendix A.

After a review of the exploration program the data appears to confirm the contention that in Section 36 the Rosebud coal bed is burnt except for the small area located in the southeast portion of the lease tract. Drill hole 36-44 penetrated a full section of Rosebud coal 23 feet thick, whereas in hole N51 E38B the Rosebud coal seemingly is burnt in part, as only 8 feet of coal appears. The McKay coal bed is present in both test holes and is 8 feet thick.

Although an accurate estimate of the coal resources present on the lease tract based upon two test holes is difficult, the Department estimates that approximately 750,000 tons of Rosebud coal and 400,000 tons of McKay coal are mineable from the state tract.

Both the Rosebud and McKay coal beds on the lease tract are mineable by surface methods. Data from hole number 36-44 gives a stripping ratio of 5 to 1, i.e., 155 feet of overburden/interburden removal would yield 31 feet of coal. The data from hole N51 E38B reveals a stripping ratio of 6.7 to 1, however the quality of the Rosebud coal is questionable.

The Rosebud coal cored in hole number 36-44 differs significantly in sulfur content from the Rosebud coal now mined by WECO at Colstrip. Total sulfur in the core sample is reported as 1.15% compared to an average 0.7% in the present mining area. Heating value of 36-44 coal (8831 Btu/lb.) is comparable to that currently being mined.

The data resulting from the analysis of the McKay coal from the test holes on the lease tract conforms with data obtained from McKay coal elsewhere in the Colstrip coal deposit. The McKay coal is currently not mined by Western Energy Company at its Colstrip mines because of marketing problems associated with high surfur content.

b. Minerals Other Than Coal

The nearest producing area for oil and gas is the Liscom Gas Field in T.1 and 2 N., R. 45 E., about 24 miles from Colstrip. Several unsuccessful wildcat wells have been drilled in the general vicinity of Colstrip. No other locateable or leaseable minerals are known to exist in the subject area.

c. Paleontology

Although no major discoveries have been reported from the Colstrip area, it is not known whether significant paleontological resources exist within the application boundaries.

3. Soils

WECO has completed a soil survey of the proposed lease area in accordance with the Departments' guidelines. The survey, however, is presently in field note form and the detailed survey results are not available for inclusion in this PER.

The survey has identified twelve mapping units on the proposed lease area, with the majority of the units consisting of soil complexes. All of the mapping units are typical of those which have already been encountered in previous soil surveys in Areas A, B, and E. The soils consist of Ustic Torriorthents and Borollic Camborthids and are found on moderate to steep slopes. The soils are typical of the residual and colluvial soils found in the immediate Colstrip area.

Should mining be proposed in the future for the lease tract, based upon existing mining in the adjacent portions of Area A, it is not anticipated that the soils of the proposed lease tract would impose significant limitations on the mining operation. If mining were proposed, the handling of soils in the lease tract area would occur in full compliance with 82-4-232(3) MCA and the rules and regulations implementing that subsection as amended by the 1979 Montana Legislature.

4. Water

a. Surface Water

The lease tract is located in the drainage of Stocker Creek, and includes portions of three small ephemeral surface drainages that drain predominately

northwestward before joining a single tributary draining northeastward to Stocker Creek. Water quality information for these ephemeral drainages is not available. Consideration of the reestablishment of surface drainages if mining is proposed in the future would be accomplished in compliance with the provisions of 82-4-231 (3) and 82-4-232 (1) MCA as amended by the 1979 Montana Legislature and the rules adopted thereunder.

A stockwater reservoir and dam is located on the lease tract and was constructed in the 1930's. Future mining of the lease tract may either eliminate the reservoir or adversely affect its' present water supply.

b. Groundwater

Groundwater investigations have been conducted by the Montana Bureau of Mines and Geology (MBMG) in Area A (Van Voast and Hedges, 1974; Van Voast, et at. 1977). In addition, further hydrologic research is presently being conducted in Area A by WECO, although no observation wells have been drilled in the proposed lease tract. Recent investigations indicate most of the groundwater used in the area is obtained from shallow aquifers within 600 feet of the surface. These aquifers are primarily the sand and coal beds of the Fort Union Formation, particularly the Rosebud and McKay coal seams.

The Rosebud aquifer is one of the most important sources of water for livestock in the Colstrip area. However, data from wells located adjacent to the lease tract indicate the Rosebud coal bed is only partially saturated in the lease area. Groundwater flow rates, therefore are slower for the Rosebud than the McKay bed.

Although uncertain, it is thought that groundwater flows northwestward through the Rosebud coal in the proposed lease area toward the Stocker Creek aquifers. It is probably recharged from the east and vertically from above.

Any future mining of the Rosebud coal on the lease tract is not anticipated to significantly affect the regional groundwater regime of the area because of the generally dry nature of the Rosebud coal.

5. Air Quality

The Colstrip area has been designated as nonattainment for primary standards relating to total suspended particulates. This designation is based on data showing both the annual standard (annual mean 107 ug/m3) and 24-hour standard (high value=428, second high value=379) have been significantly exceeded. A nonattainment area is defined as an area that does not presently meet federal, state or local air quality standards.

Presently the mining operations at Colstrip are being conducted under the state's off-set policy. In general, this off-set policy requires a reduction of the total suspended particulates (TSP) of the area before any new source of TSP can be permitted. The two 350-megawatt power plants and other coal mines operating at Colstrip are primary producers of airborne particulates and other emissions. Other sources of suspended particulates include: agricultural plowing, burning, and harvesting; industrial processing; vehicular traffic on unimproved roads; landfills; and open-burning dumps.

Since the proposed action is designed to make state-owned coal available to a continuation of existing mining and is not anticipated to result in an increase in local annual production, future mining and reclamation of the application area is not anticipated to result in a reduction of the quality of air presently occurring in the area.

Impact to the area's air quality resulting in future mining of the leased tract would be reduced in compliance with the provisions of 82-4-231(3)(m) MCA as adopted by the 1979 Montana Legislature and the rules and regulations adopted thereunder.

6. Wildlife

The lease area lies within a 10X20 mile wildlife area that has been monitored by Ecological Consulting Service, Inc., (ECON) Helena, Montana for seven years. Wildlife use of the lease application area has been low during the monitoring period. Mo mule deer (*Odecoileus hemionus*) use has been observed on the area although suitable habitat in the form of ponderosa pine-grassland and shrub-grassland does exist. The 1978 mule deer population estimate for the 200 square mile study area was 0.86 deer per square mile (ECON, 1978).

Antelope (*Antilocapra americana*) have been observed on the application area from 1974 through 1978. Observations have been low, (one to five animals) and have occurred only during spring and summer. ECON (1976) concluded the 10X20 mile study area was not optimum habitat for antelope. The majority of use on the lease area occurred in the shrub-grassland communities.

No major use areas for wildlife occur on the application area, in part resulting from the mining activities on adjacent tracts. The reader is referred to copies of the ECON Inc. studies on file in the Department's Helena office for a detailed discussion of the area's wildlife.

Two endangered species have been reported in the Colstrip vicinity. The peregrine falcon (*Falco peregrinus*) has been sighted once as a migrant through the area. The Bald eagle (*Haliaeetus leucocephalus*) is considered a winter migrant. Neither of these species has been reported in the application area.

There is no legally designated critical habitat for federal or state threatened/endangered animal species, no active bald or golden eagle nests, roosts, concentration areas, or active falcon cliff nesting sites within ¼ mile of the application area.

Should future mining be proposed for the tract, the mitigation of impacts to wildlife would occur in compliance with the provisions of 82-4-231(1)(j) MCA and the rules adopted thereunder.

7. Vegetation

The lease application area contains three major vegetative types which are in their natural forms. They include: mixed-grassland, shrub-grassland, and timber-grassland. All three types lie within the ponderosa pine savannah which encompasses the Colstrip area.

The mixed-grassland type is associated with open, treeless range on lower slopes and bottoms. The shrub-grassland type occupies sites between timber and mixed-grassland areas on mid and lower slopes. Shrub-grasslands occupy the most acreage in the application area. The timber-grassland type interspersed with associated shrubs, is found on higher elevation ridges.

A vegetation survey of the application area including identification, classification, and mapping of the plant communities has been conducted by WECO during 1979. The results of the survey, however, are currently being compiled and are not available for consideration in this PER.

8. Agriculture and Grazing:

There is no land in the application area which is used for crop production. The surface is, however, presently leased for livestock grazing. Department records (1971) estimate the Annual Unit Months (AUMs) for this tract as 0.24 with the range in good condition. The potential AUMs for the tract under a option management program has been estimated as 0.28.

Eventual mining of the tract would temporarily eliminate approximately 40.8 AUMs annually for the duration of the mining operation and an unknown amount of time afterwards necessary for the establishment of acceptable reclamation. During an active mining operation, the lease area would be fenced to prevent entry by livestock. Potential productivitity of the tract could increase following successful reclamation and a continued proper post mining management program.

9. Economics

The lease for coal mining purposes of the state-owned tract will be offered by the Montana Board of Land Commissioners on a cash bonus competitive bid basis.

The Board is required by Section 11 of the Montana Enabling Act and Article X of the Constitution of Montana to insure that the school trust fund receives full market value. Therefore, it is necessary to determine the full market value of the proposed coal mining lease and set a minimum royalty rate, rental rate and cash bonus. The following alternative formulas have been initially determined to be the full market value of the proposed coal lease based upon coal lease offerings M35734 and M35735 by the U. S. Department of Interior, Bureau of Land Management for coal of similar quality in the same area. Since the proposed state royalty rates of 30 percent and 18 percent apply to the value of the coal prior to taxation, and the federal royalty rates of 21 percent and 12½ percent apply to the value of the coal following the addition of production taxes, the state's proposed royalty rates are considered comparable to the federal royalty rates. Comments from the public concerning the value of coal will be accepted and carefully considered prior to a final determination of full market value.

1. The royalty rate shall be 30 percent of production but not less than $1.47 per ton. The rental rate shall be $3.00 per year after the first year. The cash bonus shall be at least $25.00 per acre. The advance royalty shall be $100,000 per year after the 3rd year.
2. The royalty rate shall be 18 percent. The rental rate shall be $3.00 per year after the first year. The cash bonus shall be at least $3,422 per acre payable in equal annual installments over 3 years. No advance royalty shall be required.

The successful bidder will be required to submit a bond of $10,000 to insure payment of royalties and compliance with the terms of the lease.

The Department estimates that approximately 750,000 tons of coal are mineable by strip mining methods from the Rosebud coal seam which exists on this tract. Also it is estimated that approximately 400,000 tons of coal are mineable from the McKay coal seam, although the marketing ability of the McKay coal is questionable because of its high sulfur content.

If the successful bidder chooses alternative No. 1 and bids the minimum cash bonus, it is anticipated that the state school trust will receive approximately $1,500,000 in royalties from the Rosebud coal, $510 per year in rentals, and a cash bonus of $4,250.

If the successful bidder chooses alternative No. 2 and bids the minimum cash bonus, it is anticipated that the state school trust fund will receive approximately $940,000 in royalties from the Rosebud coal, $510 per year in rentals, and a cash bonus of $581,740.

Royalty payments received from coal leasing are credited to the Public School Permanent Fund. The interest from the Permanent Fund and the income from coal leasing rentals and cash bonuses is annually credited into the ear-marked revenue fund for state equalization aid. These funds are distributed on a state wide basis by the Superintendent of Public Instruction.

10. Historical and Archaeology

An archaeologic and historic survey completed by the Mineral Research Center for the proposed lease tract identified one prominent site and seven indistinct/isolated finds in the vicinity of the tract. No sites were located on the lease tract and those identified nearby are not considered to be significant for inclusion in the National Register.

11. Conclusion

The impacts discussed in this PER are limited to the area proposed for lease for coal mining purposes. The competitive basis of the lease bidding, the lack of a developed mine plan, and the failure of a coal lease to commit the tract to future mining make any attempt to more fully discuss the potential cumulative impacts of an approved lease on adjacent lands inappropriate. It is anticipated, because of the small amounts of coal in the lease area, that any future mining plan involving the state-owned tract will include additional adjacent coal bearing areas in the mining proposal. Because of this, an EIS for the proposed lease sale is considered premature.

Literature Cited

Dobbin, C. E. 1929. The Forsyth Coal Field, Rosebud, Treasure, and Big Horn Counties, Montana. U. S. Geological Survey Bull. 812-A

ECON, Inc. 1976. Colstrip 10 X 20 Mile Area, Wildlife and Wildlife Habitat Annual Monitoring Report to the Montana Power Company. Proj. 125-85-A. 54 pp.

ECON, Inc. 1978. Colstrip 10 X 20 Mile Area, Annual Wildlife Report of The Colstrip Area for 1978. Project 195-85-A. 94 pp.

Kepferle, R. C. 1954. Selected Deposits of Strippable Coal in Central Rosebud County, Montana. U. S. Geological Survey Bull. 995-I p. 333-381.

Pierce, W. G. 1936. The Rosebud Coal Field, Rosebud and Custer Counties, Montana, U. S. Geological Survey Bull. 847-B.

Van Voast, W. A. and R. B. Hedges. 1974. Hydrology of Western Energy Company's Probable Mine Areas Near Colstrip, Southeastern Montana. State of Montana Bureau of Mines and Geology Open-File Report.

Van Voast, W. A., R. B. Hedges, and J. J. McDermott. 1977. Hydrogeologic Conditions and Projections Related to Mining Near Colstrip, Southeastern Montana. Bull. 102. State of Montana Bureau of Mines and Geology, Butte, Montana.

APPENDIX A

Analysis of Coal on Proposed Lease Tract

GREAT FALLS • BILLINGS MONTANA • BOISE IDAHO

Report of: Coal Analysis
McKay; Area A; N51E38 B

Date September 15, 1977
Job Number 69-147
Sheet 1 of 2

Report to: WESTERN ENERGY COMPANY (2)
ATTN: ROGER RICE
113 NORTH BROADWAY
BILLINGS MT 59101

RECEIVED
SEP 19 1977
WESTERN ENERGY COMPANY
GEOLOGICAL DEPT.

Sample Identification:

July 10, 1977, this coal sample was delivered to our laboratory with instructions to perform the following analyses.

TEST RESULTS:

Drill Hole: N51E38
Area : A

Depth, ft.: 114 to 121.7
Formation : McKay
Lab No. : 5784

Proximate	As Rec'd	Air Dry	Oven Dry
% Moisture	26.88	18.79	0.00
% Ash	8.71	9.67	11.91
% Volatile	26.94	29.92	36.84
% Fixed Carbon	37.47	41.62	51.25
Total	100.00	100.00	100.00

Sulfur Forms	As Rec'd	Air Dry	Oven D
Pyritic Sulfur	1.52	1.69	2.08
Sulfate Sulfur	0.05	0.05	0.06
Organic Sulfur	0.47	0.53	0.66
Total Sulfur	2.04	2.27	2.80

	As Rec'd	Air Dry	Oven Dry
% Sulfur	2.04	2.27	2.80
BTU, per pound	8,360	9,285	11,433
BTU, per pound, ash, moisture free			12,979

2.44 lbs Sulfur/ BTU^6

Ultimate	As Rec'd	Air Dry	Oven Dry
% Carbon	48.25	53.59	65.98
% Hydrogen**	6.12	5.56	4.26
% Nitrogen	0.77	0.86	1.06
% Oxygen**	34.11	28.05	13.99
% Ash	8.71	9.67	11.91
% Sulfur	2.04	2.27	2.80
Total	100.00	100.00	100.00

HARDGROVE GRINDABILITY INDEX

**Includes coal moisture content in accordance with ASTM D3176.

Northern Testing Laboratories, Inc.

September 15, 1977
Job No. 69-147
Sheet 2 of 2

Coal Analysis

Western Energy Co.
Billings, MT

MINERAL ANALYSIS OF ASH

Lab No.: 5784 McKay; Area A; N51E38 B

Mineral Analysis of Ash, %

Silicon Dioxide (SiO_2)	35.29
Aluminum Oxide (Al_2O_3)	23.75
Iron Oxide (Fe_2O_3)	20.43
Titanium Dioxide (TiO_2)	0.35
Phosphorus Pentoxide (P_2O_5)	0.09
Calcium Oxide (CaO)	10.85
Magnesium Oxide (MgO)	2.67
Sodium Oxide (Na_2O)	0.62
Potassium Oxide (K_2O)	0.28
Sulfur Trioxide (SO_3)	6.27
Undetermined	
Alkalies as Na_2O, DCB	0.11
Silica Ratio	50.97

Fusion Temperature of Ash, °F

	Reducing	Oxidizing
Initial Deformation	2200	2340
Softening (H=W)	2240	2380
Softening (H=1/2W)	2280	2420
Fluid	2350	2460

SULFUR DETERMINATION

Lab No.	Depth, ft.	% Sulfur, As Received	% Sulfur, Air Dry	% Sulfur, Oven Dry
5781	114 to 115	1.03	1.20	1.36
5783	120.7 to 121.7	1.10	1.31	1.56

Certified

cc: Western Energy - Butte (1)
Energy - Colstrip (1)

GREAT FALLS • BILLINGS MONTANA • BOISE IDAHO

Report of: Coal Analysis
Rosebud, Area A, 36-44

Date November 7, 1977
Job Number 69-147
Sheet 1 of 2

Report to: Western Energy Company (2)
ATTN: Mr. Roger Rice
113 North Broadway
Billings, Montana 59101

Sample Identification:

On October 10, 1977, this coal sample was delivered to our laboratory with instructions to perform the following analyses.

TEST RESULTS:

Drill Hole: 36-44
Area : A, Section 36

Depth, ft.: 109 to 137.6
Formation : Rosebud
Lab No. : 7992

Proximate	As Rec'd	Air Dry	Oven Dry
% Moisture	24.84	15.33	0.00
% Ash	9.02	10.16	12.00
% Volatile	28.63	32.26	38.10
% Fixed Carbon	37.51	42.25	49.90
Total	100.00	100.00	100.00

Sulfur Forms	As Rec'd	Air Dry	Oven Dr
Pyritic Sulfur	0.59	0.67	0.79
Sulfate Sulfur	0.02	0.02	0.02
Organic Sulfur	0.54	0.61	0.73
Total Sulfur	1.15	1.30	1.54

	As Rec'd	Air Dry	Oven Dry
% Sulfur	1.15	1.30	1.54
BTU, per pound	8831	9949	11750

BTU, per pound, ash, moisture free 13352

1.302 lbs sulfur/BTU^6

Ultimate	As Rec'd	Air Dry	Oven Dry
% Carbon	50.10	56.44	66.66
% Hydrogen**	6.20	5.57	4.55
% Nitrogen	0.80	0.90	1.06
% Oxygen**	32.73	25.63	14.19
% Ash	9.02	10.16	12.00
% Sulfur	1.15	1.30	1.54
Total	100.00	100.00	100.00

HARDGROVE GRINDABILITY INDEX
52.8 at 15.33% moisture

**Includes coal moisture content in accordance with ASTM D3176.

Northern Testing Laboratories, Inc.

Coal Analysis

Western Energy Co.
Billings, MT

Job No. 69-147
Sheet 2 of 2

MINERAL ANALYSIS OF ASH

Lab No.: 7992

Mineral Analysis of Ash, %	
Silicon Dioxide (SiO_2)	26.84
Aluminum Oxide (Al_2O_3)	21.26
Iron Oxide (Fe_2O_3)	13.14
Titanium Dioxide (TiO_2)	0.34
Phosphorus Pentoxide (P_2O_5)	0.26
Calcium Oxide (CaO)	25.81
Magnesium Oxide (MgO)	4.05
Sodium Oxide (Na_2O)	0.42
Potassium Oxide (K_2O)	0.30
Sulfur Trioxide (SO_3)	7.20
Undetermined	0.38
Alkalies as Na_2O, DCB	0.09
Silica Ratio	38.43

Fusion Temperature of Ash, °F	Reducing	Oxidizing
Initial Deformation	2250	2270
Softening (H=W)	2260	2280
Softening (H=1/2W)	2290	2320
Fluid	2320	2350

SULFUR DETERMINATION

Lab No.	Depth, ft.	% Sulfur, As Received	% Sulfur, Air Dry	% Sulfur, Oven Dry
7991	109 to 110	2.72	3.25	3.66
7993	130.6 to 131.6	3.79	4.58	5.15

Certified

cc: Western Energy - Butte (1)
Western Energy - Colstrip (1)

GREAT FALLS • BILLINGS MONTANA • BOISE IDAHO

Report of: Coal Analysis
McKay, Area A, 36-44

Date November 7, 1977
Job Number 69-147
Sheet 1 of 2

Report to: Western Energy Company (2)
ATTN: Mr. Roger Rice
113 North Broadway
Billings, Montana 59101

RECEIVED
NOV 11 1977
WESTERN ENERGY COMPANY
GEOLOGICAL DEPT.

Sample Identification:

On October 10, 1977, this coal sample was delivered to our laboratory with instructions to perform the following analyses.

TEST RESULTS:

Drill Hole: 36-44
Area : A, Section 36

Depth, ft.: 171.5 to 179.7
Formation : McKay
Lab No. : 7989

Proximate	As Rec'd	Air Dry	Oven Dry
Moisture	28.06	17.90	0.00
% Ash	9.17	10.47	12.75
% Volatile	25.71	29.35	35.75
% Fixed Carbon	37.06	42.28	51.50
Total	100.00	100.00	100.00

Sulfur Forms	As Rec'd	Air Dry	Oven Dr
Pyritic Sulfur	0.96	1.10	1.34
Sulfate Sulfur	0.03	0.03	0.04
Organic Sulfur	0.60	0.68	0.82
Total Sulfur	1.59	1.81	2.20

	As Rec'd	Air Dry	Oven Dry
% Sulfur	1.59	1.81	2.20
BTU, per pound	8254	9421	11474

BTU, per pound, ash, moisture free 13151

1,93 lbs Sulfur/BTU^6

Ultimate	As Rec'd	Air Dry	Oven Dry
% Carbon	47.66	54.40	66.26
% Hydrogen**	6.33	5.65	4.44
% Nitrogen	0.81	0.92	1.12
% Oxygen**	34.44	26.75	13.23
% Ash	9.17	10.47	12.75
% Sulfur	1.59	1.81	2.20
Total	100.00	100.00	100.00

HARDGROVE GRINDABILITY INDEX
44.4 at 17.90% moisture

**Includes coal moisture content in accordance with ASTM D3176.

Northern Testing Laboratories, Inc.

Coal Analysis

Western Energy Co.
Billings, MT

Job No. 69-147
Sheet 2 of 2

MINERAL ANALYSIS OF ASH

Lab No.: 7989

Mineral Analysis of Ash, %	
Silicon Dioxide (SiO_2)	25.53
Aluminum Oxide (Al_2O_3)	17.25
Iron Oxide (Fe_2O_3)	21.48
Titanium Dioxide (TiO_2)	0.35
Phosphorus Pentoxide (P_2O_5)	0.09
Calcium Oxide (CaO)	23.75
Magnesium Oxide (MgO)	4.05
Sodium Oxide (Na_2O)	0.57
Potassium Oxide (K_2O)	0.61
Sulfur Trioxide (SO_3)	5.77
Undetermined	0.55
Alkalies as Na_2O, DCB	0.15
Silica Ratio	34.13

Fusion Temperature of Ash, °F	Reducing	Oxidizing
Initial Deformation	2200	2265
Softening (H=W)	2240	2280
Softening (H=1/2W)	2260	2320
Fluid	2280	2360

SULFUR DETERMINATION

Lab No.	Depth, ft.	% Sulfur, As Received	% Sulfur, Air Dry	% Sulfur, Oven Dry
7988	171.5 to 172.5	1.92	2.33	2.58
7990	178.7 to 179.7	0.52	0.62	0.71

Certified

cc: Western Energy - Butte (1)